Responses by MapTech (in italics)
4/4/2005

Comments on "TMDL Development for the Chowan River Basin"
April 1, 2005
Jason Ericson

Comments

- In the last paragraph of executive summary page xxxv the text states that Stage I implementation is represented by Scenario 3 or 4. For Big Hounds Creek, the Stage I implementation is Scenario 6. It may also be helpful to mention in the executive summary what the Stage I goals are.

The definition of Stage I implementation was added to the Executive Summary (both Tidal and Non-Tidal documents). The added sentence is "The Stage I water quality goal was to reduce the number of violations of the instantaneous standard in the impaired segments to less than 10%."

- Page 1-1: Sappony Creek is listed as impaired. I'm not sure if it should be mentioned here as impaired because of the de-listing. Also, Figure 1.5 and Table 1.1 show Sappony as impaired.

The description of Sappony Creek was not changed because it was listed as impaired when the TMDL was contracted and hydrology and water quality modeling were done. Section 5.2.2.5 (Non-Tidal document) describes that the stream has been de-listed and the results of this modeling support the de-listing.

- Figure 2.6: There are only 6 measurements shown for Cypress Creek? I believe there should be 30.

There are 7 of 12 fecal coliform measurements for Cypress Creek that have a corresponding flow measurement (taken the same day). These are the data included in the figure.

- Figure 2.8: It seems that the critical condition for Rattlesnake (Creek) Swamp could be considered high flows.

There are violations at every flow regime according to the New Instantaneous Standard line (400 cfu/mL).

- Page 2-28: In the explanation of the BST results it would be helpful to include an explanation of what constitutes a statistically significant BST result.

An explanation of the statistics used in analyzing the BST data was added (both Tidal and Non-Tidal documents). The added verbiage is "The statistical significance was determined through 2 tests. The first was based on the sample size. A z-test was used to determine if the proportion was significantly different from zero (alpha = 0.10). Second, the rate of false positives was calculated for each source category in each library, and a proportion was not considered significantly different from zero unless it was greater than the false-positive rate plus three standard deviations."

- Page 3-4: There is no explanation here of how pet estimates were determined. There is an explanation later but it may be appropriate to also include an explanation here.

This paragraph is present as an overall description of the watershed. Because there is more detail later in the chapter is was not deemed necessary to expand the verbiage here.

- Tables 3.2 & 3.3: There are no sources for the livestock rankings by county or the wildlife populations by county.

The references for the values in these tables appear in the text, but were added as footnotes also. They are "VASS, 2002" for Table 3.2 and "VDGIF, 2004" for Table 3.3 (both Tidal and Non-Tidal documents).

- Page 3-13: An explanation of what is included in the waste load estimate of 75 gal/person/day may be appropriate.

The 75 gal/person/day is the flow of waste from one person per day including sewage and water used for washing.

- Page 4-13: The distribution of the 79 sewer overflows should be mentioned. Are the majority of these in Virginia Beach

By dividing the document into Tidal and Non-Tidal this has been addressed. There were 12 reported overflows in Non-Tidal and 59 in Tidal.

- Page 4-50: Beginning of 2nd paragraph should be "HSPF" instead of "HAPF"

This has been corrected (both Tidal and Non-Tidal documents).

- Chapter 5 number scheme starts at 5-103

This has been corrected (both Tidal and Non-Tidal documents).

- Page 5-104: The enterococci equation does not include the fecal coliform factor.

The definition of C_{fc} was added to the text (in the Tidal document only). The segment "and C_{fc} is the concentration of fecal coliform in cfu/100 ml" was added to the end of the current sentence "where C_{ent} is the concentration of enterococci in cfu/100 ml".

COMMONWEALTH of VIRGINIA

DEPARTMENT OF ENVIRONMENTAL QUALITY

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RE: Written Comments on the Chowan River Basin TMDL

Dear Kevin:

Thank you for your written comments on the Chowan River Basin TMDL. Responses to your comments are italicized below. Where possible, I have included the full comment, a summary of the comment, or the comment heading in your original correspondence.

Please let me know if you have any questions regarding the information provided. I am looking forward to our continued interaction throughout the Chowan TMDL Implementation Plan process.

I would be happy to make myself available to further discuss this project and upcoming efforts.

Sincerely,

R. Christopher French
TMDL Coordinator
Piedmont Regional Office, DEQ

1. **Consistent use of Watershed/Subwatershed**

The western rivers are referred to as the "Blackwater" and "Nottoway" river watersheds. These should properly be referred to as the "Upper Blackwater" and "Upper Nottoway,"…

Also, there is no discussion of the individual subwatersheds (or "watershed seqments" as used in the 305 report), although there is reference to them in several tables (K34, K32, etc.) Also, the permitted discharge maps (Fig. 3-4 to 3-7) depict another set of watershed boundaries for each stream, and the model segments (Figure 4-1 and 4-2) are also slightly different.

All reference to the Blackwater River and Nottoway River watersheds were changed to read "Upper Blackwater River watershed" and "Upper Nottoway River watershed" as per this comment.

The subwatershed boundaries used to list streams on the Virginia Section 303d lists were not used in modeling and were, therefore not discussed in the TMDL document.

The watersheds in Figures 3.4 and 3.5 are labeled in the legends. These are the watersheds contributing to the impaired stream segments. The watersheds in Figure 4.1 are the watersheds used in modeling hydrology and water quality and are also labeled in the figure legend. The watersheds/subwatersheds do not change throughout the TMDL. However, different watersheds/subwatersheds are highlighted in different sections of the document.

2. **Last paragraph of Section 1.1 is confusing.**

London Bridge was listed in 1994 (before Nawney Creek).

Sappony Creek discussion is confusing. Sappony Creek was threatened in 1998, then listed in 2002 and is now "proposed for delisting" in 2004, but isn't 2/20 (10%) acceptable and also DEQ is progressing as if EPA has approved the delisting.

Rewrite to say "Sappony Creek has been proposed for delisting and therefore is not included in this study." OR "Sappony Creek has been proposed for delisting and the model results support this conclusion (Section 5.2.2.5)."

Last sentence: "…Chowan Study Area stream segments do not support…," this should be SOME stream segments in the area do not support or THE STREAM SEGMENTS LISTED ON THE TABLE do not support…

Some of these comments refer to the Tidal section of the Chowan TMDL. The Tidal section has been extracted and is now a separate TMDL document. The comment period of the Tidal section has been completed and this document has been finalized.

The description of Sappony Creek is now "The impaired segment of Sappony Creek was listed in the Virginia 1998 Section 303(d) Total Maximum Daily Load Priority List and Report as fully supporting but threatened. The segment was downgraded and extended during the 2002 assessment cycle. During the year 2004 cycle, the fecal coliform violation rate was 2/20, and Sappony Creek was proposed for delisting."

3. **USGS Gauging Stations**

There needs to be a discussion or at least a table of USGS gauging station numbers and text locations and periods of record for each. Also, to be more "user-friendly," use the text locations when referring to the stations.

In the critical flow section (Section 2.3), did the gauging stations have any water samples that could be used for a direct flow vs. FC analysis? What is the time period of record for the stream samples? Discuss all data sets before showing any analysis of the data, or include references to what sections the discussions are located.

A description of the USGS stations and the period of record is provided in Section 4.5. While the text description of the stations may be more user friendly to some, the station numbers are referenced because they give a more precise description of the stations.

There were no water quality samples taken by USGS at the same time as flow measurements. The time period for each DEQ sample station are shown in Table 2.2. The sentence was added to Section 2.3: "A description of the data used in this analysis is shown in Table 2.2".

4. **TMDL Assessment/TMDL Development Samples**

The TMDL Assessment (Section 2.4.1.1) data uses historical data through March 2004. TMDL Development (Section 2.4.1.2) data was collected between August, 2003 and July, 2004. Where these data sets combined for any other analysis or model runs? The following section (2.4.2) implies that Development data were only used for BST analysis.

Only TMDL Assessment data (data collected by DEQ) was used for modeling because the modeling time periods were in the 1990's.

5. **Trend and Seasonal Analysis**

By placing these sections (2.4.2.2 to 2.4.2.6) in 2.4.2 Analysis of BST Data implies only using the BST data. This should be its own section.

What is the time period for the rainfall data?

What are the time periods for the USGS stations and why are there differences between the stations used in the Critical Flow analysis and Model runs and why use a station that only had data through 1986? And if using older stations, why not use the Zuni station that was discontinued in 1988?

Trend analysis	Critical Flow	Model
02043190	02043190	02043200
02043200	02043200	02044500
02044000 (1970-1986)	02044500	02045500
02047000 (1941-2002)	02045500	02047000
02047500 (1970-2002)	02047500	02047500

The Trend Analyses have been moved to their own section (2.4.3).

The three processes described (i.e., trend analysis, critical flow analysis, and hydrologic calibration) have different data needs. Trend analyses require long periods of record with data included as close to the current time frame as possible. Critical flow analyses (i.e., concentration-duration plots) require flow data that is representative of the hydrologic conditions (e.g., high flow, moderate flow, or low flow) in the area where and at the time when water quality samples were collected. Hydrologic calibration and validation require flow during the time period(s) identified as being representative of historical conditions and concurrent with available data. Different USGS stations were used in these analyses based on their appropriateness for each analysis.

6. **Section 3. Source Assessment**

There is no discussion of soil types. While the individual model parameters account for different soil characteristics, the type of soil indicates what would be acceptable limits for the model parameters. This is important, since it appears that Infiltration may be one of the main factors and the wide range of INFILT values used in the model.

While fecal bacteria are often deposited on soil, soil itself is not an originating source of fecal bacteria, therefore a discussion of soil types is not included in the Source Assessment Chapter. Soil types were used in the initial estimates for hydrology parameters, including INFILT. These values were used in hydrology calibration, which accounts for the wide range of values.

7. **Section 4.3**

An additional source of contamination that may need to be considered is bottom sediments. The concentrations of organisms in the sediment can be much higher than in the water column, and die off rates are much lower.

This may help explain why there are no critical flow conditions. High flows are impacted by land inputs and low flow concentrations are impacted by sediment sources.

Although stream sediments can be a medium for fecal bacteria growth, DEQ does not measure this when taking water samples, so we have no data from sediments to use in the modeling of fecal bacteria. The presence of fecal bacteria in stream sediments is accounted for during water quality model calibration.

7b. **Section 4.4**

Hydraulic Function Tables: The text states that the maximum depth used was 50 feet, but the "F-table" (Table 4.6) goes to a depth of 479.6 feet.

The sentence *"A maximum depth of 50 ft was used in the F-tables."* has been removed from the document.

8. **Section 4.6.1**

Provide graphs of sensitivity analysis of hydraulic parameters.

Graphs of the hydrologic parameters are not shown because they are unnecessary given that the data are provided in Table 4.10. Extra graphs would only serve to lengthen the report without adding much to the content of the report, given that each curve would be a line graph with 5 points.

9. **Section 4.6.2**

Sensitivity ranges were -50% to + 50%, except for MON-INFLW CONC which was -100% to +100%. Why the difference? In ranges from -50% to +50%, this parameter seems to have similar effects. FSTDEC seems to have the greatest effect on the results.

Sensitivity analysis for deposits discusses and depicts large changes due to land applications versus direct deposits. The final sentence states that for geometric means, the response is the opposite ("direct loads had the greatest impact"). Provide the details on this analysis.

If land applications increase instantaneous concentrations, but direct deposits increase long-term concentrations, what was the "residence time" of the instantaneous concentrations in the stream? This could have important effects on sampling data and implementation, especially in areas with large and possible sporadic land applications.

The ranges of values used in the sensitivity analyses are based on the model's limitations as well as the real-world limitations of the parameter. For instance, the concentration of fecal bacteria in interflow (MON-INFLW CONC) can be virtually any value.

The sensitivity analysis plots showing the impact of direct and land-based loads on the geometric mean concentration of fecal bacteria were omitted from the report, but have been inserted. The "residence time" of fecal bacteria is affected by many things including rainfall volume, FSTDEC, runoff volume, and concentration in runoff. However, the difference seen in the response of the overall load and the geometric mean are due to the delivery mechanisms involved. A much larger overall load comes from land-based sources, but only during runoff-producing storm events. On the other hand, direct loads are persistent, regardless of flow condition. The geometric mean concentration is not sensitive to discrete spikes in concentration caused by runoff events, but reflects the long-term condition, which is more impacted by direct depositions than loads in runoff.

10. **Section 4.7.3**

Tables 4.23, 4.24, 4.25 are out of place (Blackwater/Nottoway validation data in the middle of tidal section discussion.)

The Tidal section has been extracted and is now a separate TMDL document. The comment period of the Tidal section has been completed and this document has been finalized.

11. **Section 4.7.5**

To clarify the interpretation of the calibration statistics, the following text:

The standard errors in Table 4.22 range from a low of 10 to a high of 259. The higher values in this range can be considered quite reasonable when one takes into account the censoring of maximum values that is practiced in the taking of actual water quality samples. The standard error will be biased upwards when an observed high value censored at 8,000 cfu is compared to a simulated high value that may be an order of magnitude or more above the censor limit. Considering the data in Table 4.22, it is evident that the higher standard errors coincide with the higher simulated maximum values as expected. Thus, the standard errors calculated for these impairments are considered an indicator of strong model performance.

Has been replaced with:

The standard errors in Table 4.22 range from a low of 10 to a high of 259. Even the highest value in this range can be considered quite reasonable when one takes into account the censoring of maximum values that is practiced in the taking of actual water quality samples. The standard error will be biased upwards when an observed high value censored at 8,000 cfu is compared to a simulated high value that may be an order of magnitude or more above the censor limit. The highest standard error (259) coincides with the highest simulated maximum value (66,764). The next highest standard error is 104 and the majority of standard errors are less than 50. Thus, the standard errors calculated for these impairments are considered an indicator of strong model performance.

The Standard Error is actually based on the square of the differences. This eliminates the occurrence of positive and negative values of error canceling out, and gives an increased value of error if the individual differences are highly variable.

While there are many methods of measuring model error, this method was introduced because it takes into account the inherent problem of comparing data from an instantaneous grab sample from a highly variable parameter (e.g., fecal bacteria) to modeled output. The intent of this measure was to account for temporal variations in input data that could result in the model leading or lagging the observed value.

The statistics for the validation results will be included in Appendix C with the validation figures.

Since the TMDL program is based on compliance of the standard it is appropriate and imperative to compare the modeled and observed violation rates.

11A. **Section 5.2**

The C_{ent} equation applies only to the Tidal section and has been corrected in the Tidal document. As described earlier, the Tidal section has been extracted and is now a separate TMDL document. The comment period of the Tidal section has been completed and this document has been finalized.

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May 27, 2005

Henry McBurney
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RE: Written Comments on the Chowan River Basin TMDL

Dear Mr. McBurney:

Thank you for your written comment on the Chowan River Basin TMDL. Your input regarding the possible source of bacterial contributions to Rattlesnake Swamp is a valuable source of information for addressing local water quality issues. We will use this information to help plan the next steps for addressing fecal input from kennels. In addition, we have provided your comments to our Pollution Response Program for follow up. You can contact Milt Johnston in the DEQ Tidewater Regional Office at 757-518-2151 for additional information.

Please let me know if you have any questions regarding the information provided. I am looking forward to our continued interaction throughout the Chowan TMDL Implementation Plan process.

I would be happy to make myself available to further discuss this project and upcoming efforts.

Sincerely,

R. Christopher French
TMDL Coordinator
Piedmont Regional Office, DEQ